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RECENTLY PUBLISHED RESEARCH OF THE
KARPOV INSTITUTE OF PHYSICAL CHEMISTRY, USSR

"Some Properties of Real Crystals of Vanadium Nitride,"
V. A. Epel'baum and E. F. Ormont, Karpov Inst Phys Chem

"Zhur Fiz Khim" Vol 21, 1947, pp 3-10

Effect of mode of formation on properties of a polycrystalline body is studied. NH_4 vanadate was heated in an NH_3 current; resulting mixture analyzed by chemical means and by X-rays. V_2O_5 was main product at 125-300°, V_2O_4 at 400-600°, V_2O_3 at 700°. VN at 800-1100°. Some VN samples were heated at 600-1400°. Density, lattice spacing, and abrasive efficiency were maximum after heating at 1200°; maximum density was 5.86; maximum spacing 4.125 Å. After this treatment VN contained less than 1% of VO . A sample containing 1.17 V for 1 N atom had a lower density than VN because of holes in lattice. Electrical resistivity of VN was about 2.6×10^{-4} ohms per sq mm per meter.

"The Mechanism of Oxidation of the Simplest Gases by Oxygen on Thin Silver Layers," S. M. Faynshteyn, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 37-50

Thin Ag layers produced by sublimation on glass adsorb, at -193° and 0.01 mm. Hg, about 5 molecular layers of O_2 , assuming geometric and real area to be identical. About 0.25-0.5 of this O_2 cannot be removed by evacuation.

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tion between -183° and 300° . After evacuation at -183° less O_2 is adsorbed in a second and subsequent experiment. Ag layers prepared at -183° and brought to 0° have no adsorption capacity. Oxygen which cannot be removed by evacuating reacts with H_2 or CO at $7-40^{\circ}$, reaction being more rapid with CO. One molecule of adsorbed O_2 reacts with 1.2-1.7 molecule H_2 or CO. Oxygen adsorbed at -183° loses capacity of reacting with H_2 after heating to 200° . Perhaps AgO forms and does not dissociate because in it O atoms are not close enough to combine to O_2 molecules. H_2 also reacts with O atoms on Ag crystals. Neither H_2 nor CO is adsorbed by Ag layers at -183° . From rate of reaction, probability of oxidation of a molecule striking Ag-O complex is calculated.

"Inorganic Peroxides. XI. Higher Oxides of Potassium," I. A. Kazarnovskiy and S. I. Reykhshteyn, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, 245-55

The O pressures above KO_2 (preparation described) are 0.35, 1.45, and 1.65 O.1 mm Hg at 300° , 360° , and 370° , respectively. Pressure remains constant on removing O until composition K_2O_2 is reached, when it drops to about 0.05 mm. Thus K_2O_3 does not exist. Dissociation is reversible, and KO_2 can be obtained by heating H_2O_2 in O. From molecular fraction of KO_2 , refraction of univalent anion O_2 is calculated to be 6.6. Heat of formation K_2O_2 is calculated to be 117,000 calories by using thermochemical data of Forcrand and above pressure data.

"Apparatus for Determining Dissociation Pressures," S. I. Reykhshteyn and I. A. Kazarnovskiy, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 257-60

Sample is suspended on a quartz spiral, extension of which is 0.2 mm per milligram. Sample is heated in a vacuum; pressure attained determined with a McLeod. Thus, simultaneous determination of degree of decomposition and dissociation pressure is possible. Thermoregulator used is described.

"The Behavior of Iron Electrode in Alkaline Solutions at Low Temperatures," E. Kalmykova and S. Levina, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 325-30

An electrode of compressed Fe powder was polarized in KOH. Hydrogen overvoltage η was greater the lower the temperature. Temperature coefficient of η was, e.g., 1.7 milliv per degree between 30 and 50° , 3.0 between 20 and 10° , and 4.2 between 0 and -10° , all at a con-

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stant current density. Presumably, Fe is covered with an oxide film, reduction of which is slower the lower the temperature. Existence of this film is made probable by following experiment. When an Fe electrode is discharged from about 0.150 v (relative to H electrode in KOH) to about 0.5 v at -25° and system then rapidly heated to room temperature, potential first decreases to about 0.3 v, then increases again to 0.5 v; this increase is attributed to growth of oxide film also at room temperature. Stability of this film at low temperature explains low capacity of Edison storage battery below 0° .

"The Overvoltage of Hydrogen on Nickel in Alkali Solutions," P. Lukovtsev and S. S. Levina, Phys Chem Inst, imeni L. Ya. Karpov, Moscow

"Zhur Fiz Khim" Vol 21, No 5, 12 pp

Describes, with graphs and figures, experiments conducted, which showed that in a relatively strong solution of NaOH overvoltage depends on equation $n = a + b\bar{c}$ and depends greatly on concentration of solution; therefore, form and state of cathode has little effect on experimental results. (18r95)

"Liberation of Hydrogen on an Iron Cathode in Alkaline Solutions," I. Platonova and S. Levina, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 331-6

An electrode of compressed Fe powder is cathodically polarized in concentrated KOH, and its potential is determined as a function of current density \bar{c} (measured by ammeter) and of rate V of evolution of H. At high current density, V agreed with \bar{c} , but at low \bar{c} liberation of H_2 by Fe was noticeable. Anodic polarization of 0.04 v reduces V to zero. Potential of Fe in alkali is not identical with equilibrium potential of $Fe/Fe(OH)_2$. The H overvoltage on Fe is greater in 10.5 N KOH than in 4.8 KOH, partly because more concentrated KOH is more easily supersaturated with H_2 . This supersaturation causes considerable disagreement between \bar{c} and V . Overvoltage is, on a partly oxidized Fe electrode, greater than on a fully reduced.

"Crystal Structure of Cyanides. IV. X-Ray Determination of the Unit Cell and the Space Group of the Crystals of Potassium Hexacyanotriaquoruthenate and Potassium Hexacyanotriaquoferrate (Monoclinic Type)," V. A. Pospelov and G. S. Zhdanov, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 405-10

$K_4Ba(OH)_6 \cdot 3H_2O$ (I) and $K_4Fe(OH)_6 \cdot 3H_2O$ (II) / Fundamental

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monoclinic type⁷ are isomorphous. Crystals are pseudotetragonal. Unit cell contains 4 molecules, and $a = c = 9.32 \pm 0.03$, $b = 16.84 \pm 0.03$ Å, $\beta = 90^\circ \pm 5'$ for II, and $a = c = 9.3 \pm 0.05$, $b = 16.8 \pm 0.05$ Å, $\beta = 90^\circ \pm 8'$ for I. Calculated density is 1.905 for II and 2.11 for I. Space group of I is $C_{2h}^{22}-C2/c$. Because of structure variability of II crystals, this group appears in II as a pseudogroup.

"Theory of the Dynamic Method of Measuring the Rates of Gas Reactions," S. I. Pakeshetakiy and R. N. Rubinshteyn, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 449-57

Equation for kinetics of a reaction taking place in a gas stream can be found if original concentrations in gas are varied within wide limits, if rate of streaming is varied (necessary for reactions involving volume changes), and if concentration of a component is varied and ratios of all other concentrations are kept constant.

"Commutator Method Determination of the Capacity of the Mercury Electrode in Chloride, Bromide, and Iodide Solutions," T. I. Morisova and M. A. Frokurnin, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 463-7

Curves are given for differential capacity of Hg electrode in 7 to 0.001 N KCl, N to 0.001 N KBr, and N to 0.0001 N KI. Minimum capacity in 0.001 N KCl is $7.6 \mu F/sq\ cm$, and in 0.01 N, $1.7 \mu F/sq\ cm$. Existence of a maximum of capacity in N KCl and N KBr is confirmed.

"Theory of Recrystallization Processes. I. Influence of the Gas Phase on Structure Transformations in Solid Phases," B. P. Ormont, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, No 5, May 1947, pp 569-74

Composition of the gas phase affects kinetics of reactions in solids. (19793)

"Theory of Recrystallization Processes. II. Influence of the Gas Phase on Structure Transformation of Chromic Oxide," M. A. Khachvanyan and B. Ormont, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, No 5, May 1947, pp 575-80

If degassed amorphous Cr_2O_3 is heated in a furnace, temperature of which is raised 3-4° per min, temperature T_1 of Cr_2O_3 remains equal to that T_2 of furnace until recrystallization starts when T_1 overtakes T_2 . Highest temperature T_m at which $T_1 = T_2$ was 570-590° in a high vacuum, 350-415° in O_2 , 500-560° in HCl gas, 550-560° in

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N_2 , and 610-630° in SO_2 at one atmosphere. A mixture of much N_2 and little SO_2 acted as pure SO_2 . After recrystallization Cr_2O_3 unit cell had $a = 5.37-5.38$ Å, $\alpha = 54^\circ 36'$. Density from unit cell dimensions was 5.22. Density of real crystals was determined in a special pycnometer. It depends on water content of crystals. (1977)

"Hydrogen Overvoltage on Lead Electrode and the Static Potential of Lead Dissolving in Sulfuric Acid," Ya. Kolotyrkin and N. Bune, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, No 5, May 1947, pp 681-7

H overvoltage η is determined in dilute H_2SO_4 , O being carefully excluded. When current density i (amp/sq cm) increases, $\eta = 1.40 + 0.12 \log i$ below $i = 4 \times 10^{-6}$, and $\eta = 1.56 + 0.12 \log i$ at higher currents; when i decreases, second equation is valid above 2×10^{-6} amp/sq cm, and first equation at smaller currents. Presumably, at low i , Pb is covered with adsorbed O. Processes of solution and deposition of Pb do not affect η -log i curve. (1976)

"Theory of the Hydrogen Overvoltage," P. D. Lukovtsev, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, No 5, May 1947, pp-689-98

Equations for overvoltage are derived by assuming that desorption of H occurs simultaneously by two processes: (combination of 2 adsorbed H atoms and reaction of an adsorbed H with H^+) and that probability of each process depends on inhomogeneity of solid surface. When specific assumptions concerning this inhomogeneity and relative rate of various processes are made, relations can be derived between overvoltage, current density, nature of electrolyte, etc. (1974)

"Dipole Moments and Structure of Organic Sulfonamides," E. N. Gur'yanova, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 633-42

Density and dielectric constant of dioxane solutions of 13 sulfonamides and of C_6H_6 solutions of 5 sulfonamides were measured at 25°. Molecular refraction for 4 lines (Li, Na, two Hg) of PhSO_2NH_2 , para- $\text{CH}_3\text{C}_6\text{H}_4\text{SO}_2\text{NH}_2$, and para- $\text{ClC}_6\text{H}_4\text{SO}_2\text{NH}_2$ in EtOH at 25° was determined. Molecular refraction for Na light of other sulfonamides was calculated. From dielectric constant and molecular refraction dipole moment μ (in 10^{-18} e.s.u.) was computed. Melting points of compounds are also given. Values in dioxane are by $0.4-0.6 \times 10^{-18}$ greater than in C_6H_6 ; hence dioxane effect here is greater than for aniline. Rotation of sulfonamide group seems to be much impeded. Angle formed by vector $-\text{SO}_2\text{NH}_2$ with axis of C_6H_5 ring is about 40-50°. There is less

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resonance between aromatic radical and SO_2NH_2 group than between aromatic radical and SO_2Cl group. Reasons for this difference are suggested.

"A Formal Theory of Conjugated (Complex) Reactions," S. Ya. Feshchetskly and R. N. Rubinshteyn, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 659-73

If several reactions of 2d and higher orders take place simultaneously or in succession, kinetic equations cannot be solved. However, a determinant can be built up that shows ratios of concentration of substances present; when process is adiabatic, temperature must be treated as a component of system.

"Thermodynamic Properties of Bivinyll and the Equilibrium Constant of the Reaction of the Preparation of Bivinyll from Alcohol," I. Godnys and V. Morozov, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 799-809

Equations are given thermodynamic properties of a mixture of two isomers, if equilibrium between isomers is known. Equations are applied to bivinyll within range 3-1200°; it is assumed that cis form is more stable than trans form. In spite of contrary assumptions, results generally agree with those of Aston, et al. Ranking of H_2O to H_2O , H_2 , and 1,3-butadiene is calculated; yield of C_4H_6 should be nearly complete at 120° and above.

"Crystal Structure of $\text{K}_4\text{N}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$, N being Iron or Ruthenium," V. A. Pospelov and G. S. Zhdanov, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 879-80

Coordinates of various atoms in monoclinic crystals (space group $\text{C}_{2h} - \text{C}2/c$) are given for Ru (or Fe), K, O, N and for H_2O . Coordinates of Fe and of two K types in tetragonal crystal (space group $\text{C}_{4h} - \text{I}4_1/a$) are also given.

"Kinetics of Synthesis and Decomposition of Ammonia on Various Catalysts," M. Tarkin and S. Kiperan, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol. 21, 1947, pp 927-33

Equation for rate v of reaction $v = k_1 P_1 (P_2/P_3)^{\alpha} - k_2 (P_2/P_3)^{1-\alpha}$, in which P_1 , P_2 , and P_3 are partial pressures of N_2 , H_2 , and NH_3 , respectively, and k_1 , k_2 , and α are constant, is integrated by assuming total pressure to be constant. Energy of activation is expressed

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as a function of α . Best composition of gas mixture is given by $P_2:P_1 = 3\alpha$. Above equation is valid only when system is not too far removed from equilibrium state. Variations of adsorbed amount of N_2 may cause decomposition of NH_3 to be zero-order reaction at very low NH_3 concentrations. Consideration of earlier experiments shows that equation is valid for various catalysts (Fe, Mo, W, U, Ce, Mn, Os, Ru, Cu, and Pt), that α usually is 0.5, that activation energy is almost independent of nature of catalyst. This proves that reaction mechanism is identical on various catalysts. Rate of synthesis should depend on degree of uniformity of catalyst surface.

"Application of the Photoelectrochemical Method to the Study of Heterogeneous Photosensitizers of the Zinc Oxide Type," V. I. Veselovskiy, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 983-5

Zn electrode anodically polarized in 0.1 N NaOH, therefore coated with ZnO, is sensitive to ultraviolet. Curve of sensitivity against wavelength λ is almost coincident with that of light absorption by ZnO against λ . If Zn/ZnO electrode is polarized to ~ 1.5 V. against Ag/Ag₂O in 0.1 N NaOH and illuminated, e.m.f. changes to ~ 0.6 v. Photogalvanic current between illuminated Zn/ZnO and Ag/Ag₂O is proportional to light intensity. Quantum yield reaches 0.5. This shows that whole ZnO layer, not just its surface, is active. From variations of e.m.f. and current strength, electrostatic capacity of active system is about $30 \mu F/cm^2$. Above observations are used to explain photosensitizing effect of ZnO.

"The Energy of Systems Containing Conjugated Double Bonds and Hetero Atoms. I. The Resonance Energy of Six-Membered Nitrogen Heterocycles," M. E. Dyatkina, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 21, 1947, pp 929-1006

For calculating energy of pyridine, etc., in addition to factor δ introduced by Wheland and Pauling, a factor γ is considered that takes account greater interaction between O and N than between two O atoms. Value of γ for N is between $\sqrt{2}$ and $\sqrt{3}$. A probable range of resonance energies is calculated also for condensed nitrogenous rings. Introduction of a vinyl or a Ph group into pyridine ring increases resonance energy, if substitution occurs in para- or meta-position, more than for ortho-substitution.

"Transitional Kinetic States of Catalytic Reactions on Porous Catalysts," S. Ya. Pashchetskiy, Karpov Inst Phys Chem, Moscow

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"Zhur Fiz Khim" Vol. 21, 1947, pp 1019-26

Measured rate of a gas reaction on a porous catalyst may be determined, depending on reaction temperature, either by rate of external gas diffusion, of internal gas diffusion, or by rate of chemical reaction proper. Transitions can extend over many degrees. Because transitions are gradual, dependence of over-all rate of reaction on temperature varies gradually. Apparent activation energy calculated from temperature coefficient of over-all rate may have any value between zero and that of true activation energy.

"Valency States in the Complexes Which Reversibly Add Oxygen," Ya. K. Syrkin, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol. 21, 1947, pp 1087-8

Electron structure of Co compounds described by Calvin, et al., is discussed.

"The Intensity of the Combination Scattering Lines and the Structure of Organic Compounds," P. P. Shorygin, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol. 21, 1947, pp 1125-34

Structure of organic compound often affects intensity I of some of their Raman lines more than their frequency ν and dipole moment of compound. Length of an aliphatic chain has no effect. Presence of other functions also often has no effect. However, there is often great difference between aliphatic and aromatic compounds; PhCN has $I \approx 200$. Because of steric hindrance, position of NO_2 in nitrobenzylene and orthodinitrobenzene must be abnormal; these compounds have $I \approx 250$. In all instances when I is considerably raised, ν is slightly reduced; this reduction is 23 cm^{-1} for the pair MeCN and PhCN, 27 cm^{-1} for acetone and acetophenone, etc. Ratio of I for MeCN and PhCN is independent of wave length of exciting light. Such ratios often are independent of nature and amount of solvent used. Absorption in infrared is for acetophenone twice that for acetone, i.e., much less sensitive to presence of conjugated structures than is I . A semiclassical treatment of Raman effect is given.

"Crystal Structure of SiC VI and Geometrical Theory of Silicon Carbide Structures," G. S. Zhdanov and Z. V. Mizernina, Karpov Inst Phys Chem, Moscow

"Zhur Eksp i Teor Fiz" Vol. 17, 1947, pp 3-6

Structure of 33-layer SiC VI described by Thibault is shown to be identical with that predicted by authors and designated in Zhdanov's notation by (2.3.3.3)3. This is demonstrated by a comparison of Thibault's intensities with those calculated for close packing

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(2.3.3.3)₃, rhombohedral, space group D_{3d}^{15} — $R\bar{3}m$, lowered to C_{3v} — $R\bar{3}m$ filling half of empty points, $a = 3.08$, $c = 83.3$ Å., calculation being analogous to that previously made for SiC V. Series of structures SiC I, (2.3)₃; SiC VI, (2.3.3.3)₃, and SiC V, (2.3.3.3.3.3)₃ is derived from 6-layer SiC II, (3.3) by omission of every 6th, 12th, and 18th tetrahedron layer, respectively. Absence of simpler types in SiC indicates that one-layer packing is energetically unfavorable. Another type of structure, SiC IV (4.3)₃, can be represented as derived from SiC II by addition of one extra tetrahedron layer for every 6 layers of SiC II. Further types of structures resulting from omission or insertion of layers in a regular order, are predictable, without, however, giving rise to as many different allotropic modifications of SiC. Alternation of omissions or insertions leads to a superimposed secondary period, termed superperiodicity, an instance of which, of a superperiod $= 680$ Å., found against a background of SiC I and describable by symbol $[2.2(2.3)]_3$ or $[3.3(2.3)]_3$, corresponds to one disturbance in every 90 layers, without its being decided as yet whether this disturbance is an omission or an addition.

"The Electronic Levels and Absorption Spectrum of Naphthalene," L. A. Blyumenfeld, Phys Chem Inst imeni Karpov, Moscow

"Zhur Fiz Khim" Vol 21, No 5, May 1947, 9 pp

Experiments resulted in discovery of weights for different stimulations, interpretation of absorption spectrum of naphthalene and its monoform and an accounting of electronic energy levels when structures with two and three extended links were disregarded. (18T103)

"The Crystal Structure of Dinitronaphthalenes. I. X-Ray Determination of the Unit Cell and the Space Group of Crystals of 1,8-Dinitronaphthalene," G. S. Zhdanov and M. M. Umanakiy, X-Ray Lab, Phys Chem Inst imeni Karpov, Moscow

"Zhur Fiz Khim" Vol 21, No 5, May 1947, 2 pp

Crystals were obtained by crystallization out of an acetone solution. Concluded that 1,8-dinitronaphthalene crystals belong to rhombic system. Point group of symmetry under X-ray observation showed D_2 -222 (center of symmetry excluded). (18T104)

"The Crystal Structure of Dinitronaphthalenes. II. X-Ray Determination of the Unit Cell and the Space Group of a Crystal of 1,5-Dinitronaphthalene," N. G. Sevastyanov, G. S. Zhdanov, M. M. Umanakiy, X-Ray Lab, Phys Chem Inst imeni Karpov, Moscow

"Zhur Fiz Khim" Vol 21, No 5, May 1947, 3 pp

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Crystals were obtained by crystallization out of an acetone solution according to methods of V. G. Vasil'yev. Concluded that 1,5-dinitronaphthalene crystals belong to monoclinic system. Point group of symmetry under X-ray observation showed $C_{2h}-2m$ (center of symmetry included). (19T105)

"Normal Potential of Cesium in Liquid Ammonia," V. A. Pleskov, Karpov Inst, Moscow

"Zhur Fiz Khim" Vol 20, 1946, pp 163-4
 "Acta Physicochim, URSS" Vol 21, pp 235-8

Cell 0.2827 atomic-percent of Cs/0.01 N $CaNO_3$ /saturated KNO_3 /0.1 N $Pb(NO_3)_2$ /Pb in liquid NH_3 at $-35.0 \pm 0.2^\circ$ has e.m.f. 1.0785 v. Temperature coefficient of e.m.f. between -38° and -23° is 0.0010 v degree. Normal potential of Cs in NH_3 is by 0.02 v more negative than that of Rb.

"Photogalvanic Processes on a Gold Electrode," V. I. Veselovskiy, Karpov Inst, Moscow

"Zhur Fiz Khim" Vol 20, 1946, pp 269-96
 "Acta Physicochim, URSS" Vol 21, 1946, pp 803-35

Au wire, 1 mm in diameter, immersed into an electrolyte solution in a silica-glass capillary, was anodically polarized by means of a similar Au electrode in a similar capillary; its potential V determined with respect to a Pt electrode, previously charged with H, in a third capillary. Au wire was illuminated for 0.5-1 sec and change, V , of its potential was measured with a string galvanometer. Following tests were carried out: (a) experiments in H_2SO_4 at different polarizations; (b) experiments in H_2SO_4 at different wavelengths λ and light intensities; experiments in other solutions including KNO_3 and KOH . Some experiments with longer illuminations are reported and discussed. Findings are given. Description of a polarized adsorbed O atom is believed to be main step of photogalvanic effect; majority of these O atoms require 2.4 e.v. for desorption. Author deduces a semiempirical equation connecting ΔV with I , λ , and V . It is confirmed by experiments.

"X-Ray Study of Vanadium Nitride. III. The System VN-VO," V. A. Yapel'baum and A. Kh. Brager, Karpov Inst

"Zhur Fiz Khim" Vol 20, 1946, pp 459-60

Specimens obtained by heating K_2V_4 vanadate or by partial oxidation of VN, containing V, O, and N, are solid solutions of VO in VN. They have NaCl lattices. Its spacing is 4.06 Å. for pure VO and increases linearly with concentration of VN to 4.129 Å. for pure VN.

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"Kinetics of the Decomposition of Ammonia on Copper,"
S. Kiperman and M. Temkin, Karpov Inst

"Zhur Fiz Khim" Vol 20, 1946, pp 461-5

Dixon's results agree with Temkin's equation, $\omega = k (p_1^2/p_2)^{3/2}$, ω being the rate of decomposition, p_1 and p_2 pressure of NH_3 and H_2 , respectively, k and ω constants.

"Adsorption of Oxygen on Iron and the Effect of Adsorbed Oxygen on the Properties of Iron Electrodes," R. Barshteyn, N. Shumilova, K. Gol'bert, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim," Vol 20, 1946, pp 789-801

"Acta Physicochim URSS," Vol 21, 1946, pp 785-802

Fe band, Fe wire, or Fe powder prepared by reduction with H_2 of $\text{Fe}(\text{NO}_3)_3$ or $\text{Fe}(\text{OO})_5$ was heated in H_2 and degassed at 500-850°. When O_2 in small amounts was admitted to this Fe at 20°, rate of adsorption was high and constant until adsorbed volume reached value V ; after this rate rapidly decreased. For smooth Fe, V was 0.023 cc per 100 sq cm of geometric surface area. For Fe powder, $V = 0.045$ cc per gram. One gram of this powder adsorbed 0.015 cc of H_2 in conditions corresponding to unimolecular adsorption. If adsorption of O_2 was unimolecular, then cross section of O_2 molecule was 5×10^{-16} sq cm, specific surface area of Fe powder was 0.5 sq cm, ratio of real to geometrical area of smooth Fe was 2:3.5. V slightly increased from -133° to -128°, remained constant until -73°, and rapidly increased at higher temperatures. At 200° it was 2.4 cc per gram of Fe. Electrochemical potential of an Fe electrode in alkali solution was not affected by preceding adsorption of 2×10^{16} molecules of O_2 per sq cm of actual surface, but adsorption of 4×10^{16} molecules made Fe passive. To change potential of Fe by anodic oxidation, 8×10^{17} molecules/sq cm of O_2 are required. During anodic polarization both formation and solution of oxide film take place. Pure, fully reduced Fe is not pyrophoric and readily sinters at 550-560°. Admixture of O or S raised sintering temperature and makes Fe pyrophoric.

"Solvation of Non-electrolytes and Compressibility of Their Solutions," A. G. Pasynskiy, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 20, 1946, pp 981-94

Intense compression of solvent around each dissolved dipole molecule because of electrostriction gives rise to an "incompressible volume," V (expressed in molecules of solvent per molecule of solute). To determine V , velocity of supersonic waves in solutions was measured and compressibility, β , calculated from these velocity values and compared with compressibility of pure solvent. β of aqueous solutions decreases almost linearly when concentration, g (in percentage weight),

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increases. Lowest $\beta \times 10^6$ and highest g values are determined for MeOH, EtOH, PrOH, ethylene glycol, sucrose, AcOH, EtCO₂H, butyric acid, isobutyric acid, valeric acid, mandelic acid, malic acid, tartaric acid, citric acid, acetone, urea, glycine, and alanine. It is found that V is independent of length of a molecule and is approximately additive for its polar groups. Every OH group contributes 2-3 molecules of H₂O to V ; COOH contributes 3-4; CO 2, and NH₂ 1 molecule. It is concluded in various literature that aldehyde group binds 2 molecules of H₂O. In organic solvents V is about 0.2 molecule. Effect of a polar group on β is about 0.3 to 0.5 that of a uni-univalent electrolyte.

"Occlusion of Gas From an Air Current by a Layer of Granular Material. II. An. N. Tikhonov, A. A. Zhukhovitskiy, Ya. L. Zabeshinskiy, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 20, 1946, pp 1113-26
 "Acta Physicochim URSS" Vol 22, 1947, pp 121-36

Theory is extended to systems in which adsorption isotherm is concave toward axis of pressure, such as Langmuir isotherm.

"Kinetics of Heterogeneous Reaction on Porous Catalysts," S. A. Falekhetkiy and R. N. Rubinshteyn, Karpov Inst Phys Chem

"Zhur Fiz Khim" Vol 20, 1946, pp 1127-36
 "Acta Physicochim" Vol 21, 1946, pp 1075-83

Diffusion of reactants to surface of a porous catalyst is discussed. Conditions are defined under which (a) no hydrodynamic flow is created by reaction, (b) diffusion of only one reactant needs to be considered, (c) temperature gradient within catalyst grain has a measurable effect. A mathematical relation between measurable and true reaction rate is given.

"Diffusion Processes in the Condition of Natural Turbulence," N. N. Tunitakiy, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 20, 1946, pp 1137-41

Natural turbulence of atmosphere can significantly accelerate coalescence of aerosols, rate of evaporation of drops, heat exchange between drops and atmosphere.

"Kinetics of Polymerization in the Presence of an Inhibitor," Kh. S. Bagdasar'yan, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 20, 1946, pp 1415-20

Rate of polymerization is calculated as a function of

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original concentration of inhibitor and of ratio n/n_0 ,
 n being variable concentration of active polymers and
 n_0 concentration in absence of an inhibitor.

"Electrostatic Energy of Lattices of the Calcium Carbide Type," L. I. Kazarnovskaya, Karpov Inst of Phys Chem, Moscow

"Zhur Fiz Khim" Vol 20, 1946, pp 1403-10

Lattice energy V is calculated by Ewald's method for different ratios c/a in lattice. For CaO_2 , CsO_2 , KO_2 , BaO_2 , and SrO_2 , c/a is 1.161, 1.153, 1.178, 1.288, and 1.305, respectively; V is 813.7, 177.9, 195.1, 823.1, and 827.5 kg.-cal./mole, respectively.

"Progress of Heterogeneous Catalytic Reactions in A Stream. I. General Equations. A Heat-Insulated System," S. Y. Pshchetskiy and R. N. Rubinshteyn, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 20, 1946, 1431-34

General quantitative theory is given for steady state of heterogeneous reactions taking place when streams through a bed of catalyst. Rate of over-all reaction can be determined by rate of actual reaction process, by rate of diffusion toward catalyst, or by that within grains of catalyst. Temperature of heat-insulated catalyst is calculated for different rates of flow, concentrations of components, and lengths of bed. Retardation due to reaction products is considered.

"Adsorption Equilibrium on Heterogeneous Surfaces," M. Tsakin and V. Levich, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 20, 1946, pp 1441-57

By assuming that adsorbed layer is unimolecular and that no forces operate between adsorbed molecules, it is possible to calculate relation between value of energy of adsorption and area for which this value is valid, if adsorption isotherm is given. Adsorption isotherms deduced by Il'in, Jura, and Harkins cannot be reconciled with above assumption.

"The Fundamental Photogalvanic Effect," V. I. Veselovskiy, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 20, 1946, pp 1493-5

If primary action of irradiation is discharge of an anion near an electrode, frequency ν of red boundary of photogalvanic effect is given by approximate equation $h\nu = I + W - e\phi$, I being electron affinity of anion, W its energy of hydration, and $e\phi$ work function of electrode. Equation is applied to discharge of Br^- near an uncharged Ag elec-

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trode, and a correct value for W of Br^- is obtained.

"Electrode Potentials in Anhydrous Formic Acid," V. A. Fleskov, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 20, 1946, pp 153-62
 "Acta Physicochim," Vol 21, 1946, pp 41-54

Reversible electrode potentials of Hb, Cs, Na, K, Li, Ca, Zn, Cd, Hg, Pb, Cu, Ag, and Hg in anhydrous formic acid at 25° were measured. Potential series differ little from series in water. A shift in positive direction is observed in those elements (Zn, Cd) whose ions, though highly hydrated in aqueous solution, display no marked tendency toward solvation in formic acid. In general latter should be considered a solvent with small solvation power. Considerable positive shift of H potential testifies to small energy of solvation of proton in formic acid and fully bears out acid nature of this solvent, which is also displayed in other chemical properties.

"Kinetics of Ammonia Synthesis on Molybdenum Catalyst," N. Kiperman and N. Temkin, Karpov Inst Phys Chem, Moscow

"Acta Physicochim, URSS" Vol 21, 1946, pp 267-82
 "Zhur Fiz Khim" Vol 20, 1946, pp 369-78

Experimental data confirm work of Temkin and Pyshev on synthesis of NH_3 on promoted Fe catalyst and extend results to Mo catalyst. A flow system was used with 2 cc of catalyst. Mo catalyst was prepared by reducing ammonium molybdate in NH_3 for 20 hours at 600-650°. X-ray diffraction patterns indicate that catalysts operate in form of metallic Fe and Mo_2N . Data for both catalysts support kinetic equation suggested by Temkin and Pyshev, value of α for both catalysts is 0.5. Apparent activation energy of NH_3 decomposition on Mo catalyst as calculated from synthesis rate is 42.5 kg-cal/mole. NH_3 synthesis on Fe and Mo is considered to have same mechanism.

"The Critical Heats of Formation and Critical Bond Energies of Chemical Compounds," B. Ormont, Karpov Inst Phys Chem, Moscow

"Acta Physicochim, URSS" Vol 21, 1946, pp 409-12

Critical bond energy W^* is defined as value of total bond energy W necessary to secure stability of substance under standard conditions ($T = 298^\circ K$, $P = 1$ atm). Then $W - W^* = \Delta W$ characterizes stability of compound. Critical heat of reaction Q^* and heat of sublimation S_{H_2} are related to W^* by equation $W^* = Q^* + S_{H_2}$.

"Covalent Justification of Pauling's Electrostatic Valence Rule," N. Dyatkina, Karpov Inst Phys Chem, Moscow

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"Acta Physicochim, URSS" Vol 21, 1946, pp 377-8

Possible use of Pauling's electrostatic valence rule (for crystal structure) as an indication of ionic character of bonds is discussed.

"Kinetics and Mechanisms of Catalytic Hydrodehydrogenation Reactions. I. The Kinetics of the Dehydrogenation of Cyclohexane and Methylcyclohexane in the Presence of a Hydrogen Acceptor," M. Ya. Kagan and R. M. Flid, Karpov Inst Phys Chem, Moscow

"Acta Physicochim, URSS" Vol 21, 1946, pp 358-76
 "Zhur Fiz Khim" Vol 20, 1946, pp 503-16

Kinetics of reaction $C_6H_{12} + C_6H_5CH_3 \rightleftharpoons C_6H_6 + C_6H_{11}CH_3$ are studied in both forward and reverse directions over a Pd (15% Pd on SiO_2 gel) and a Cr_2O_3 (20% Cr_2O_3 on SiO_2 gel) catalyst. Temperature range investigated was 125-170° for Pd, 327-366° for Cr_2O_3 catalyst. There was no H evolved. Activation energies of forward and reverse reactions are equal, ~10 kg-cal on Pd and ~13 kg-cal on Cr_2O_3 . Dehydrogenation of cyclohexane over Cr_2O_3 in absence of H acceptor (with liberation of H_2) has an activation energy of 40 kg-cal. Rate data indicate conjugate dehydrogenation is a reversible first-order reaction. It is retarded by toluene and benzene over Pd, but not over Cr_2O_3 . Dehydrogenation of cyclohexane in absence of H acceptor is retarded by H over Cr_2O_3 , but not over Pd.

"The Electrochemical Properties of Highly Purified Ferri-Aluminosilica Gels and Sols," M. Shishniashvili and V. Kargin, Karpov Inst Phys Chem, Moscow

"Acta Physicochim, URSS" Vol 21, 1946, pp 705-22

Highly purified $Al_2O_3 \cdot 4SiO_2$, $Al_2O_3 \cdot 2SiO_2$, $Al_2O_3 \cdot 2Fe_2O_3$, which changed composition to $Al_2O_3 \cdot 2SiO_2$ and $Al_2O_3 \cdot 1.8SiO_2$, respectively, on continued electrodialysis, contain no free electrolyte or oppositely charged ions. The addition of 1 micromole per liter of electrolyte imparts a positive charge which decreases on further electrolyte addition until coagulation occurs. For 0.001N solutions of KNO_3 and K_2SO_4 , cataphoresis results check with Muller's coagulation theory for uni-univalent and bi-bivalent salts, leading to a particle radius of 30×10^{-7} cm, checking ultramicroscopic data. Net charge was found to be 83 and 76 electrons per particle, respectively, at coagulation. Titration curves with 0.1 N solutions of HCl , H_2SO_4 , FOH , $Ba(OH)_2$, and 0.2 N H_3PO_4 indicated an isoelectric point at pH 6.8-7.0, independent of gel composition, and hence not due to compensation of acid and base groups. Aluminosilica gels are not electrolytes, contrary to Mattson's theory.

"Chemical Stability of Metal Carbonyls and Carbonyl Halides. I," B. Ormont, Karpov Inst Phys Chem, Moscow

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"Acta Physicochim, URSS" Vol 21, 1946, pp 741-8

Calculation of equilibrium pressure of ammoniates by Nernst equation gives values of stability in agreement with experiment. Extension to data on heats of formation for $\text{FeI}_2(\text{CO})_4$, $\text{FeBr}_2(\text{CO})_4$, and $\text{FeCl}_2(\text{CO})_4$ show that these compounds are unstable at 298°K , whereas $\text{Cu}_2\text{Cl}_2 \cdot 2\text{CO}$ and $\text{Cu}_2\text{Br}_2 \cdot 2\text{CO}$ are thermodynamically stable at 298°K .

"Physicochemical Interpretation of the Characteristic Curve of the Photolayer," Kh. S. Bagdasar'yana, Karpov Inst Phys Chem, Moscow

"Zhur Tekh Fiz" Vol 16, 1946, pp 703-12

It is assumed (a) that probability of a photoelectron being neutralized by Ag ion depends on depth of potential depression in which electron is located, (b) that frequency of a potential depression having energy $\epsilon_0(1-x)$ is proportional to x , (c) that a latent image nucleus must have q or more atoms of Ag. Equation $N/N_0 = 1 - \exp. [-A(\log E - \log B)^2]$ is derived for ratio of developed grains N to total number of grains N_0 . A is a constant inversely proportional to ϵ_0 , ϵ_0 being deepest potential depression in layer. B is a constant inversely proportional to ϵ_0 and proportional to q . E is average number of light quanta absorbed by a grain. Equation agrees with experiment. From experimental data, q is calculated to be 9 to 29; probably this value is too high because only Aq nuclei at grain surface are effective. Tangents to curves N/N_0 against $\log E$ in their inflection points cross in one point, if several curves referring to one emulsion but different times of development are compared. If all nuclei are equally effective, this point of crossing lies below abscissa; and if one nucleus in a grain is more effective than others, this point lies above abscissa. These conclusions agree with results by Nietz (Eastman Kodak, 1922).

"Analysis of the Crystal Structure of SiC^{IV} (51-Layered Packing)," G. S. Zhdanov and Z. V. Minervina, L. J. Karpov Inst Phys Chem

"Compt Rend Acad Sci URSS" Vol 48, 1945, pp 182-4

An analysis is made of crystal structure of various Si carbides using numeral symbols for close packing of spheres developed by Zhdanov. Assumption that structure identified by Ott (1928) as SiC^{IV} is analogous to 17 layered packing allows for two probable structural models: (I) 2.3.3.3.3.3 and (II) 2.2.2.2.2.2.3, where both packings are rhombohedral and of similar symmetry ($D_{3d} - R_{3m}$). A comparison of calculated and experimental values of intensities of X-ray interference patterns excludes II and confirms I, which is a modification of SiC^{IV} (packing symbol 3.3).

"Superperiodicity in Silicon Carbide Crystals," G. S.

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Zhdanov and Z. Minervina, Karpov Inst Phys Chem

"Zhur Fiz Khim" Vol 9, 1945, pp 244-5

X-ray study of a certain SiO crystal showed secondary diffraction maxima indicating periodicity of 240 Å., corresponding to 95 elementary SiO layers. This recalls discovery by H. Ott (1928) of a SiO crystal showing periodicity of 129 Å., corresponding to 51 layers. Superperiodicity must arise from kinetic factors affecting crystal growth, such as impurities accumulating on face of a growing crystal, or influence of neighboring crystals having different orientations.

"The Crystal Structure of Cyanides. II. Structure of Cadmium Cyanide," B. A. Shugan and G. S. Zhdanov, Karpov Inst Phys Chem

"Acta Physicochim, URSS" Vol 20, 1945, pp 247-52

$\text{Cd}(\text{CN})_2$ crystals were synthesized from gaseous $(\text{CN})_2$ and $\text{Cd}(\text{OH})_2$. After filtration, crystals of 0.4 mm were deposited from solution by drying. X-ray powder photographs were made from white powder of density 2.23. Crystal structure thus determined is isomorphous with $\text{Zn}(\text{CN})_2$. Space group is T_d . Dimensions of body-centered cube are $a = 6.32 \text{ Å}$, $N = 2$, $\delta_x = 2.17$. Electronic structures are discussed.

"The Crystal Structure of Cyanides. III. Structure of Gold Cyanide," G. S. Zhdanov and B. A. Shugana, Karpov Inst Phys Chem

"Acta Physicochim, URSS" Vol 20, 1945, pp 247-52

Structure of AuCN , similar to AgCN , is built up from chain-like molecules $\text{M}-\text{C}-\text{N}-\text{M}-\text{C}-\text{N}$, but lattice is hexagonal and not rhombohedral. Au atoms and CN groups lying in alternate planes. Unit cell contains 1 molecule; $c = 5.09 \text{ Å}$, $a = 3.40 \text{ Å}$, $\delta_x = 7.30$, space group D_{3h} or D_{3d} . Difference in structure between AuCN and AgCN is attributed to prevalence of a covalent structure with a double bond.

"Occlusion of Gas From an Air Current by a Bed of Grains, I.," A. A. Zhukhovitskiy, Ya. L. Zabezhinskiy, A. N. Tikhonov, Karpov Inst, Moscow

"Zhur Fiz Khim" Vol 19, 1945, pp 253-61

Rate v of adsorption by a powder of a gas much diluted with air is determined by diffusion of gas toward grains. Diffusion within grains takes place in adsorption layer and is rapid. Rate v is proportional to $c - y$, c being average gas concentration in given layer of adsorbent bed and y concentration in equilibrium with amount adsorbed at a given moment.

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"Theory of the Diffusion Retardation of Heterogeneous Catalytic Reactions," S. Ye. Pshchetskiy, Karpov Inst, Moscow

"Zhur Fiz Khim" Vol 19, 1945, pp 376-81

When a gas mixture traverses a bed of catalyst, concentration of reaction product in outgoing gas, also measurable rate of reaction, depends on rate of diffusion of reaction product from interior of catalyst grain to its surface and on rate of diffusion of this product from grain surface into gas current. A formal theory is given for both these rates. Difference between apparent and true reaction constants is proportional to velocity of gas flow and to square of grain diameter.

"Kinetics and Mechanism of Photographic Development. II. Kinetics of Development of the Photographic Layer (A New Equation for Kinetics of Nucleus Formation in Topochemical Reactions)," Kh. S. Bagdasar'yan, Karpov Inst Phys Chem

"Acta Physicochim, URSS" Vol 20, 1945, pp 441-58

Rate of development is controlled by rate of formation of development nuclei and by rate of nuclear growth. Development nuclei are formed during induction period at spots where latent-image particles are located. Same process of electrochemical reduction $AgBr$ occurs in nuclear formation as in nuclear growth, former requiring only additional activation energy. Author assumes that a latent image particle must increase by n Ag atoms to become a development nucleus, and time necessary will vary for different nuclei owing to fluctuations. Using simplifying assumptions, he derives an equation for nuclear formation which gives an S-shaped curve. Kinetics of development are considered for 2 cases: (1) average time for nucleus formation is considerably greater than that for propagation of reaction through whole grain, (2) times are about equal. S-shaped curves representing number of developed grains as a function of time can be obtained in each case. Dependence of a curve shape on charge of active developing agent is accounted for by assumption that higher the charge, greater the value of p . Applicability of nucleus formation equation to other topochemical reactions is considered.

"The Normal Electrode Potential of Nitrogen and the Decomposition Potential of Solutions in Liquid Ammonia," V. A. Pleskov, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 19, 1945, pp 615-20

"Acta Physicochim, URSS" Vol 20, 1945, pp 578-87

Since free energy of formation of NH_3 (-5700 cal at -50°) is about 1/10 of that of H_2O and 3 charges are consumed by 1 molecule of NH_3 against 2 charges for

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H₂O, decomposition potential of liquid NH₃ should be 1/15 of that of H₂O, i.e., 0.08 v. In solutions of neutral salts this theoretical potential should be 1.82 v because of formation of alkali and acid at electrodes. Higher experimental values of decomposition potentials must be due to overvoltage. At anode N₂ is liberated in usual salt solutions since normal potential of electrode N₂/NH₃⁻ is by 2.8 v more negative than that of I₂/I⁻ in liquid NH₃.

"Kinetics of Ionic Discharge and Ionization of Adsorbed Deuterium Atoms on a Platinum Electrode," K. I. Rozental, P. I. Dolin, B. V. Ershler, Karpov Inst, Moscow

"Zhur Fiz Khim" Vol 19, 1945, pp 601-14
 "Acta Physicochim URSS" Vol 21, 1946, pp 213-34

Pt wire containing adsorbed H is polarized, capacity K and ohmic conductance C of electrode are measured. K is high at low polarization voltages and low frequencies of polarizing a.c., and low at high frequencies, when it is almost independent of voltage; at high frequencies K is chiefly that of electrical double layer. K is greater in acid than in alkaline solutions and depends on concentration of HCl more than on that of NaOH. C is high at high frequencies and low voltages. It is shown that Pt surface has a definite kind of inhomogeneity. The K values in D₂O are lower than those in H₂O for all voltages and frequencies, and C values are lower except at low frequencies. Rate of discharge of H calculated from these measurements is about 2.1-2.5 that of D when polarization is weak; at strong anodic polarizations this ratio is near 1. Value 2.1-2.5 is observed in both acid and alkaline solutions. Halpern and Cross decided against discharge mechanism of electrolytic separation of H and D because coefficient of separation is independent of acidity of solution. But this independence is result of that of ratio of discharge rates. At a constant potential adsorbed amount of D is greater than that of H; from this difference, the difference of energies of adsorption of D and H by Pt is calculated to be 1.7 calories per mole.

"Interatomic Distances and Ionic Character of Bonds," M. Dyatkina, Karpov Inst Phys Chem, Moscow

"Acta Physicochim, URSS" Vol 20, 1945, pp 683-94

Tables are given of bond distances for halides and methides of 20 elements. Subtracting covalent radius of C or X (halogen) from observed distance in MM_n or MX_n gives apparent covalent radius r_M for element M. For elements of groups 4, 5 and 6 of periodic table, r_M is smaller for halides than for methides and decreases with decreasing atomic weight of halogen. This shows that distance decreases with increasing ionic character of bond. For elements of groups of 2 and 3, and for bivalent Sn and Pb, r_M is again smaller for halides than for methides, but increases with decreasing atomic weight of halogen. This is

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due to possibility of electron attachment into free orbitals of M, which allows contribution of structures $M^+ = X^+$, this contribution being greater, the smaller the electronegativity of halogen.

"The Theory of Solution of High Polymers," A. A. Zhukhovitskiy, Karpov Inst Phys Chem, Moscow

"Acta Physicochim, URSS" Vol 20, 1945, pp 887-904

In view of strong negative deviations from Raoult's law for high polymer solutions, an attempt is made to eliminate discrepancies between theoretical and experimental values. Investigation is limited to comparatively dilute solutions. It appears to be advisable to express experimental values of partial entropy of mixing in terms of molecular characteristics. Derivation is made in terms of $\Delta S_m(x)$, which is change in entropy of two molecules when brought from an infinite distance apart to a distance r apart, and ΔS , which is deviation of entropy of solution from that of an ideal solution. Final equation is $\Delta S_2 = (R/2)v_1^2$, where ΔS_2 is partial molar entropy of second component, R is gas constant, and $v_1 = n_1(n_1x - n_2)$, in which v_1 is partial volume fraction of first component, n_1 and n_2 are numbers of polymer and monomer molecules, respectively, in solution, and x is number of polymer links. Experimental values for solutions of rubber and gutta-percha in toluene give values only 1/3 of 1/2. Reasons for deviation from theory are discussed at length.

"Determination of the Crystal Symmetry From the X-Ray Diffraction Patterns. I. Univocal Determination of the Crystal Symmetry From X-Ray Diffraction Patterns and Friedel's Law," G. S. Zhdanov, Karpov Phys Chem Inst, Moscow

"Zhur Eksp 1 Teor Fiz" Vol 15, 1945, pp 703-8

By Friedel's law, evaluation of X-ray patterns does not in general solve question of presence or absence of an inversion center. Determination of lens symmetry permits only assignment to one of 120 "X-ray groups" out of 219 space groups. However, analysis of symmetry elements and geometry of laws of extinction of reciprocal (F^2) lattice shows that, in case of definite combinations of symmetry elements, presence or absence of an inversion center can be univocally deduced and exact space group determined from X-ray diffraction. Presence of an inversion center can be established in case of 33 groups. It arises from a combination of secondary axes with a perpendicular symmetry plane or from 3 mutually perpendicular symmetry planes. Proof of absence of an inversion center is forthcoming in case of 26 groups, on basis of following: screw-axes cannot combine with perpendicular mirror planes; out of two mutually perpendicular symmetry planes, parallel to a 2-fold screw-axis, one must be a glide plane; 2 perpendicular glide planes with diagonal displacement cannot combine with a perpendicular mirror plane. The

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33 + 26 space groups, corresponding to 9 out of 11 Lavo classes, are tabulated.

"Determination of Crystal Symmetry From the X-Ray Diffraction Patterns. II. Rational Extinction Tables for the Determination of X-Ray Groups," G. Zhdanov and V. Pospelov, Karpov Inst Phys Chem, Moscow

"Zhur Eksp 1 Teor Fiz" Vol 16, 1945, pp 703-8

On basis of foregoing analysis, tables are drawn up for all of 11 Lavo classes, relating possible space groups to 120 "X-ray groups" and their extinctions. Concept of "X-ray group" is equivalent to the "diffraction symbol of space group" introduced by M. J. Buerger who, however, erroneously counts 121 such groups instead of 120, and gives no extinction tables. Present principle of classification of extinctions is possibly similar to that of Menzer.

"Partial Pressures in Real Gaseous Mixtures," M. Temkin, Karpov Inst Phys Chem, Moscow

"Acta Physicochim URSS" Vol 20, 1945, pp 713-28

"Zhur Fiz Khim" Vol 19, 1945, pp 72-82

If v_1 is the partial molecular volume of component 1 and N_1 its mole fraction, its partial pressure is $P_1 = N_1 \int_0^P (v_1/v) dP$, P being total pressure and v total volume.

"Diffusion of Linear Macromolecules. I. The Method of Measurement," T. V. Gatovskaya and A. G. Pasynskiy, Karpov Inst Phys Chem, Moscow

"Zhur Fiz Khim" Vol 20, 1946, pp 707-14

An apparatus to measure diffusion coefficients, D , according to Lamm is described. As an example, determination of D of sucrose and of gelatin is explained in detail.

"Diffusion of Linear Macromolecules. II. Determination of Molecular Weight and Polydispersity of Rubber from Diffusion Measurements," A. G. Pasynskiy and T. V. Gatovskaya, Karpov Inst Phys Chem, Moscow

"Acta Physicochim URSS" Vol 21, 1946, pp 1055-74

"Zhur Fiz Khim" Vol 20, 1946, pp 715-25

D and specific viscosity η of solutions of various rubbers in CCl_4 are determined. From η ratio r of length to thickness of particles; from r coefficient of friction, and from this coefficient and D molecular weight of M of particles are calculated. Ratio D/D_0 of coefficient of diffusion, calculated, respectively, from standard deviation and from height of curve

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"refractive index deviation against distance" is a measure of polydispersity. Values of $D \times 10^7$, r , M , and D/D_1 are given for natural rubber, for a reprecipitated natural rubber, for a natural rubber heated in air, for a commercial bivinyl rubber, for a laboratory bivinyl rubber freed from monomer, and for a laboratory bivinyl rubber containing some monomer. The M values calculated from are, at M less than 100,000, much smaller than above values.

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